



## iH<sub>2</sub>O<sub>2</sub>: Iron catalyzed H<sub>2</sub>O<sub>2</sub> production

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### What is the problem?

Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) is an important chemical used for the bleaching of paper, preparation of chemicals, water treatment, and disinfection. Currently, H<sub>2</sub>O<sub>2</sub> is almost exclusively produced by the [anthraquinone process](#) (Figure 1) that uses a large amount of organic chemicals and palladium catalysts to produce this very simple molecule. As a result, H<sub>2</sub>O<sub>2</sub> is ranked as one of the [top 10 most energy-intensive chemicals](#) in the United States, and the production is only economically feasible at centralized large scale production sites. One of the simplest ways to synthesize H<sub>2</sub>O<sub>2</sub> is the reaction of H<sub>2</sub> and O<sub>2</sub> using a catalyst. Currently, [palladium](#) (Pd) is the most active catalyst in this reaction. Combination of this process and electrolysis of water will enable onsite production of H<sub>2</sub>O<sub>2</sub> for water treatment at remote locations. However, the price of Pd catalysts is one of the burdens of this process.

### What is your solution?

In this project, we will develop simple and cheap [organometallic](#) iron (Fe) catalysts to synthesize H<sub>2</sub>O<sub>2</sub> from O<sub>2</sub> and H<sub>2</sub> (Figure 2). Iron is the most abundant transition metals in the Earth's crust, and used in important industrial processes such as [Haber–Bosch process](#) and [Fischer–Tropsch process](#); however its use in the formation of H<sub>2</sub>O<sub>2</sub> is unknown. We are aiming to synthesize iron catalysts that can react with H<sub>2</sub> and form Fe-H species. By tuning properties of iron catalyst, we will generate Fe-H species that have similar reactivity as the key Pd-H species and transfer two H from H<sub>2</sub> to O<sub>2</sub> to form H<sub>2</sub>O<sub>2</sub>. Our preliminary experiments showed that our iron catalyst can generate this type of Fe-H! Now, we are developing a process to form H<sub>2</sub>O<sub>2</sub> from H<sub>2</sub> and O<sub>2</sub> using this catalyst.

**Keywords:** Hydrogen peroxide, hydrogen, Catalyst, Iron

#### Current method

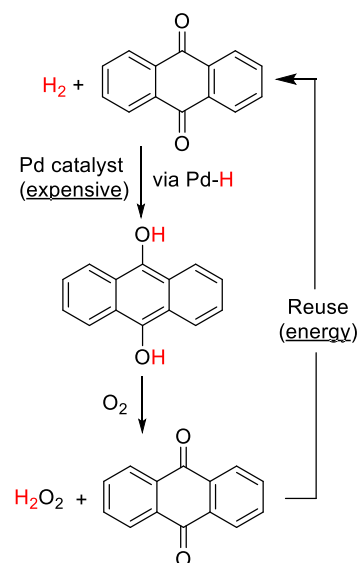


Figure 1 Current method.

#### Our method

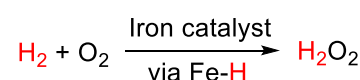


Figure 2 Our method.

#### Other resources

- [The group homepage](#)

#### Contribution to SDGs



For more information:

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